Ensemble Prediction System Development for Hydrometeorolgical Testbed (HMT) Application

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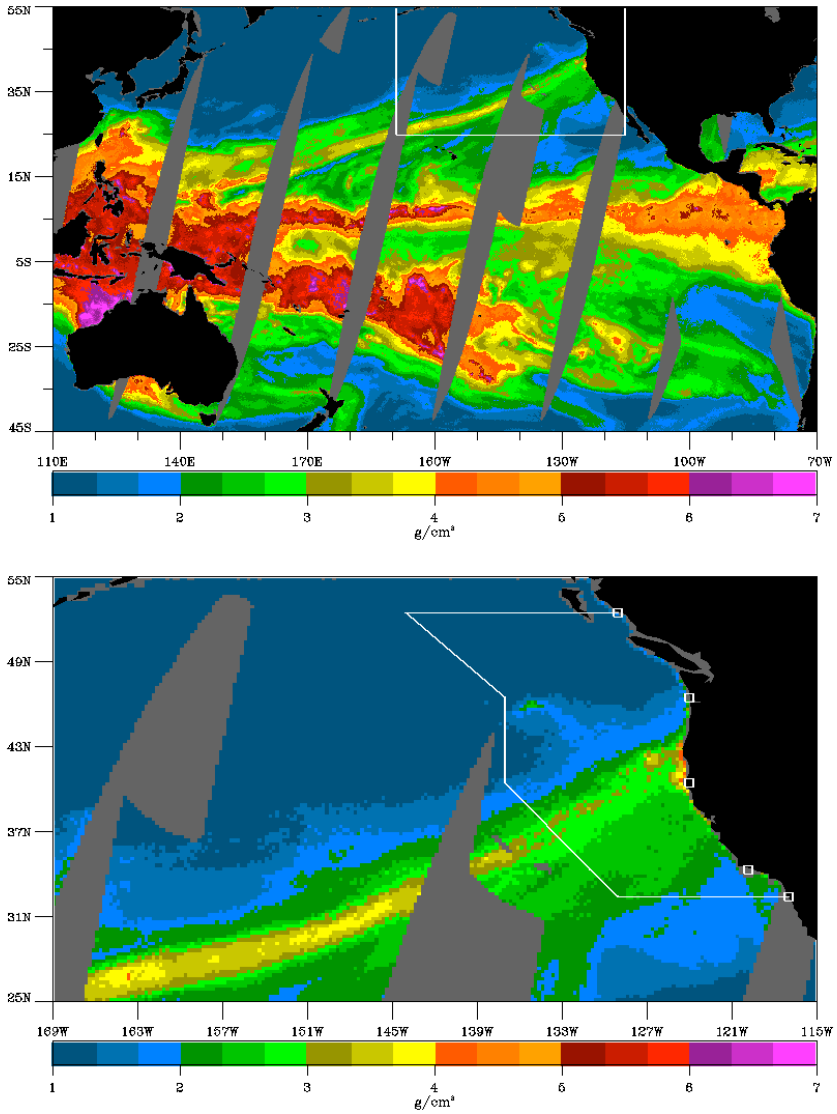
HMT Overview

❖ **Goal is to improve forecasts of rain and snow and associated hydrology**

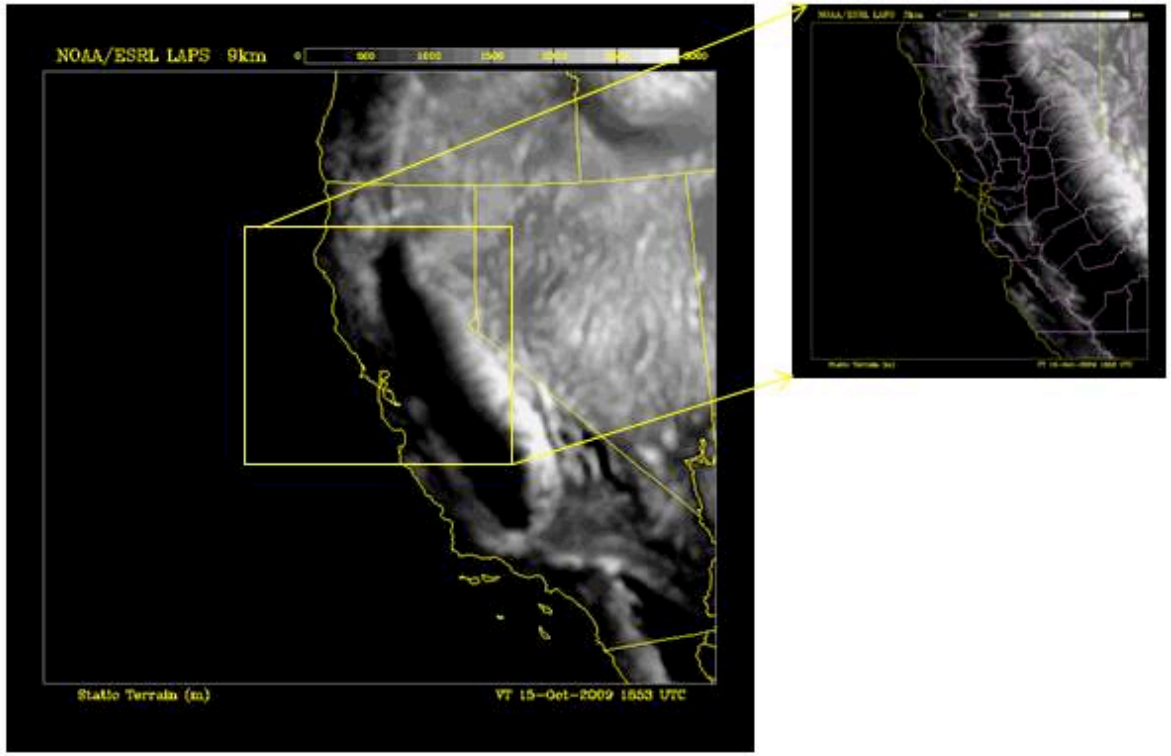
❖ **Uses local-state-federal, and private-public-academic partnerships**

o During the winter season significant precipitation events in California are often caused by land-falling "atmospheric rivers" associated with extra tropical cyclones in the Pacific.

o Due to the terrain steepness and soil characteristics in the area, a high risk of flooding and landslides is often associated with these events.



EXPERIMENT DESIGN 2009-2010

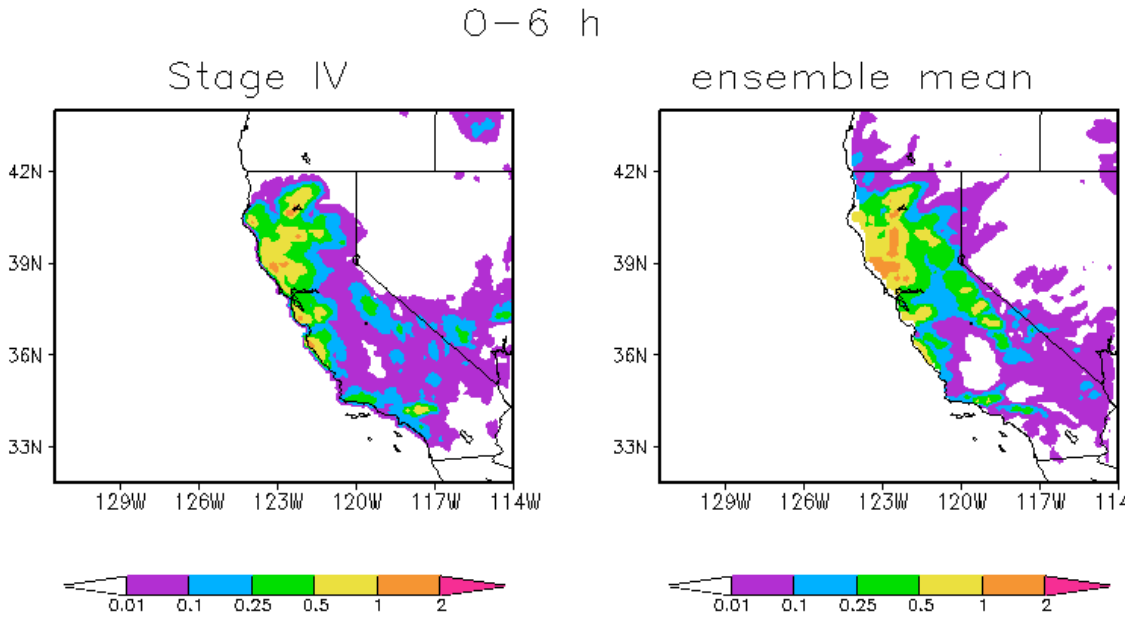


Nested domain:

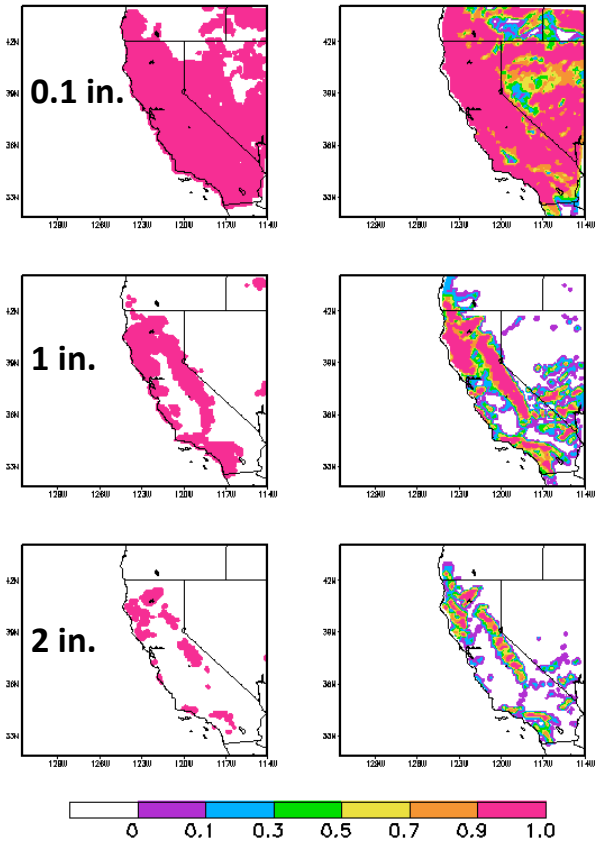
- Outer/inner nest grid spacing 9 and 3 km, respectively,
- 6-h cycles,
- 9 members
- Mixed models, physics and boundary conditions

HMT QPF and PQPF

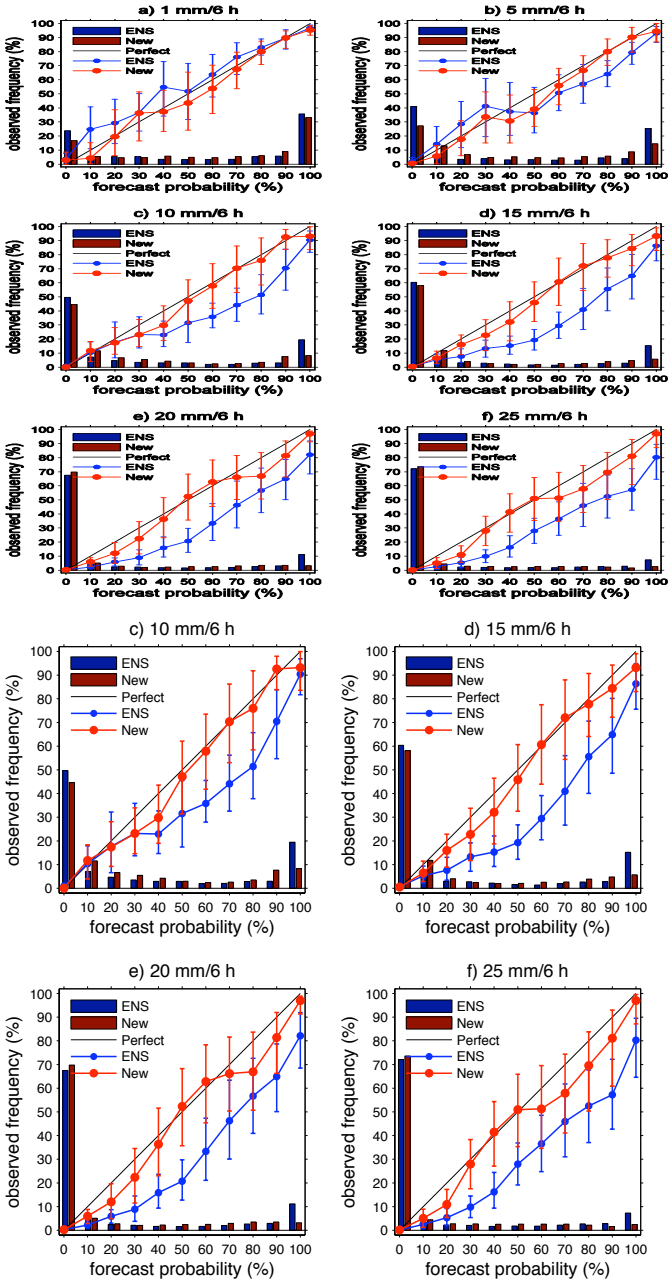
48-hr forecast starting at 12 UTC, 18 January 2010



24-hr PQPF

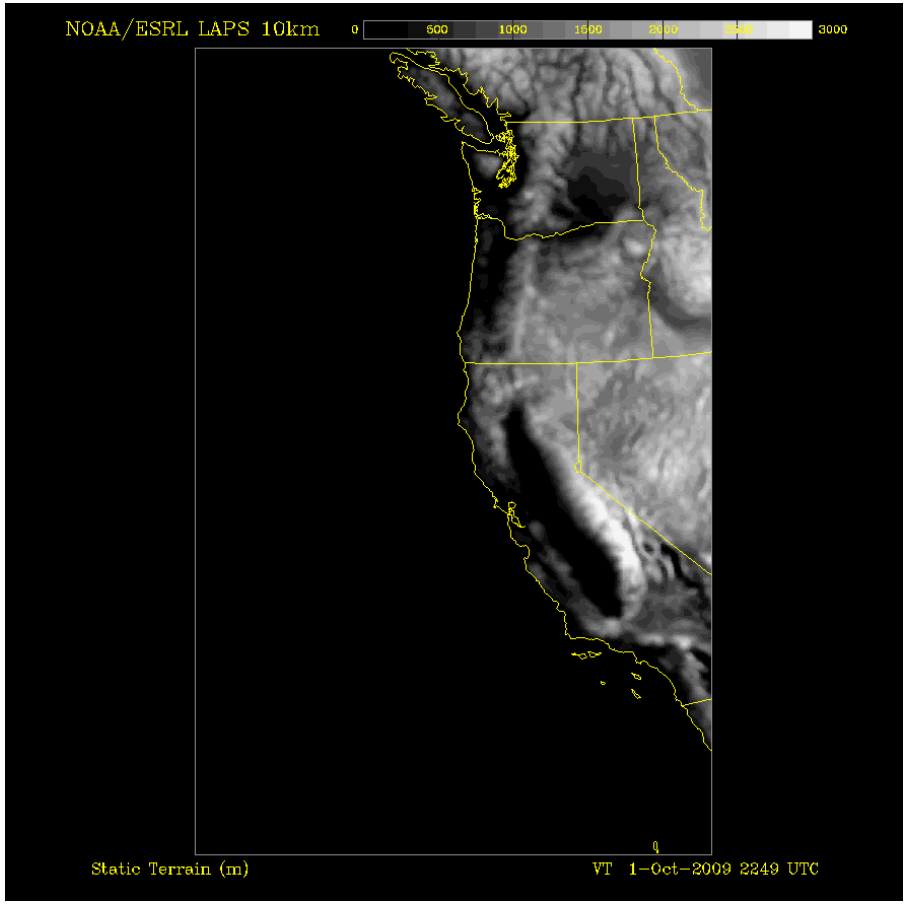


Calibration of PQPF (statistical post-processing)

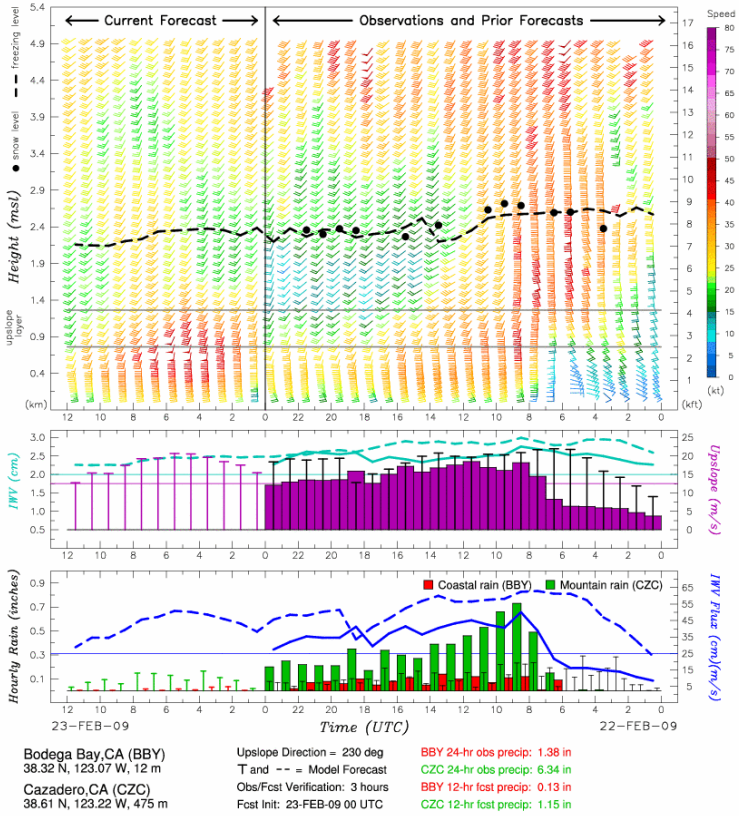


An example of probabilistic QPF (PQPF) calibration by using linear regression. The reliability notably improved after the calibration. Several IOPs were used for training purpose.

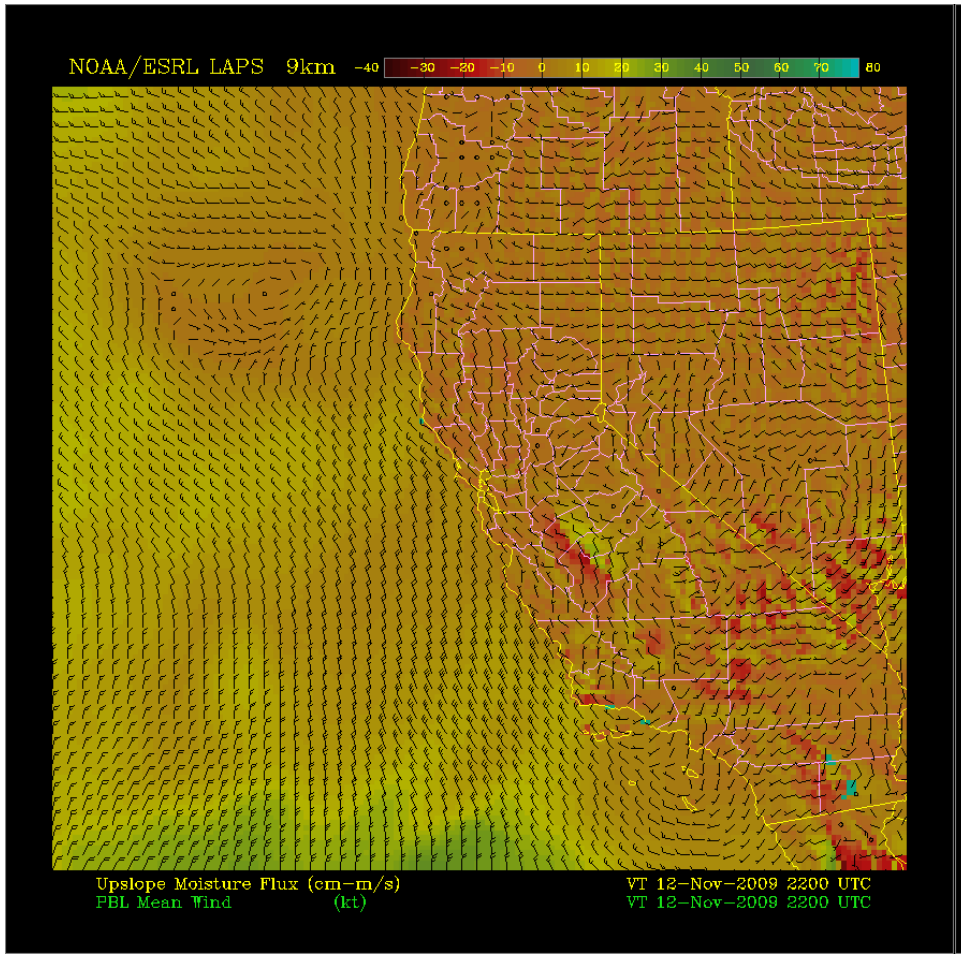
DETERMINISTIC MODEL RUN FOR PSD's MOISTURE-FLUX FORECASTING TOOL

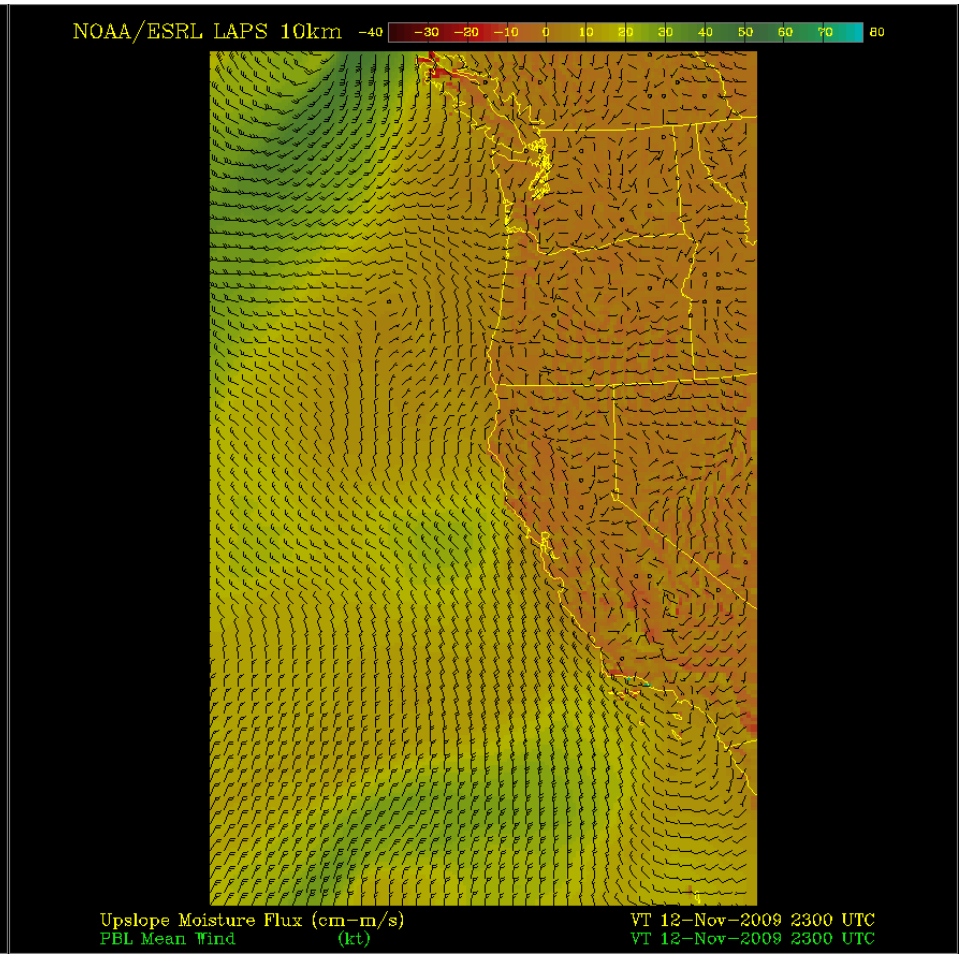


- 10 km horizontal grid spacing
- Hourly update
- 12-hr forecast
- LAPS initial conditions
- NAM LBCs
- HRRR



Upslope Moisture Flux





Runoff experiments

Validation events: IOP5, HMT2007

The distributed hydrologic model:

Two-Dimensional Runoff Erosion and Export (TREX) model

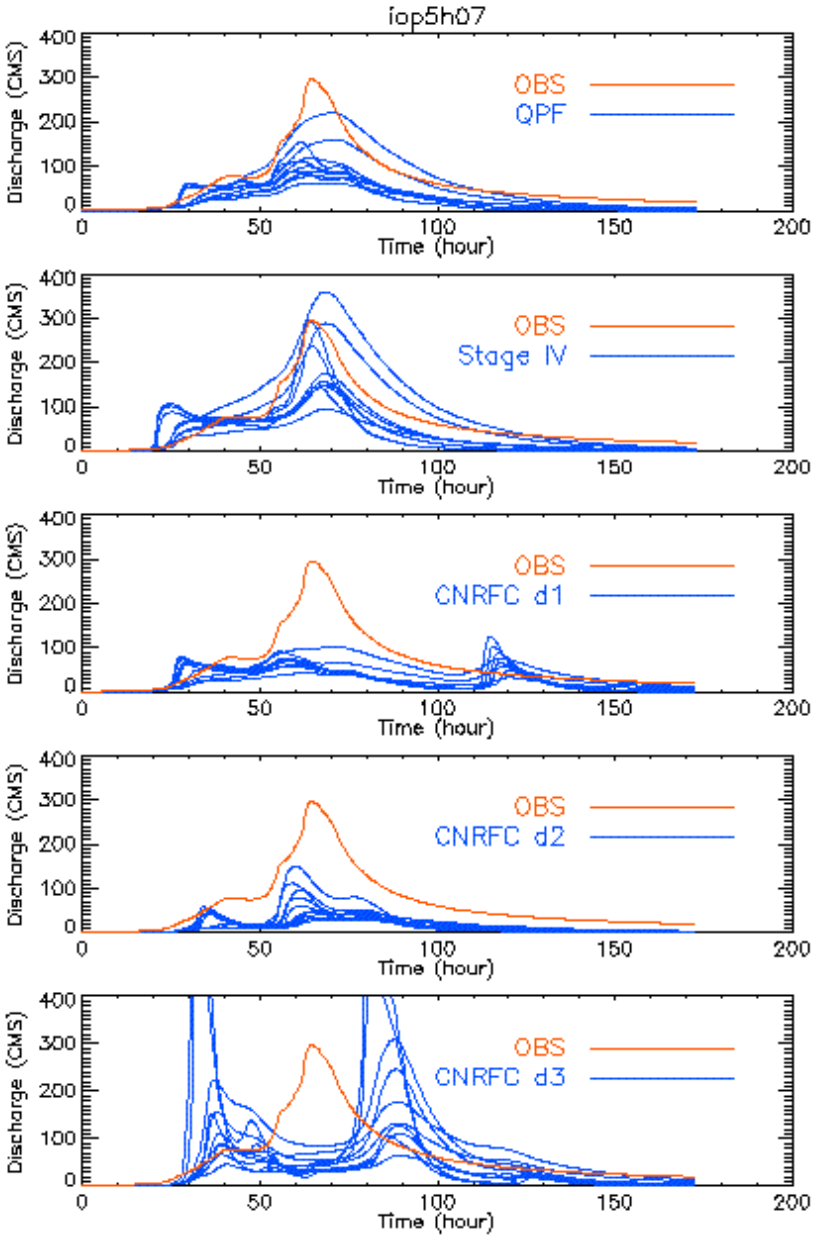
100 m^2 pixel

Ensemble created from 12 combinations of hydro model parameter perturbations (calibrated from IOP1HMT2006) using inputs from:

1) 0-6 h ensemble mean QPF, 3-km

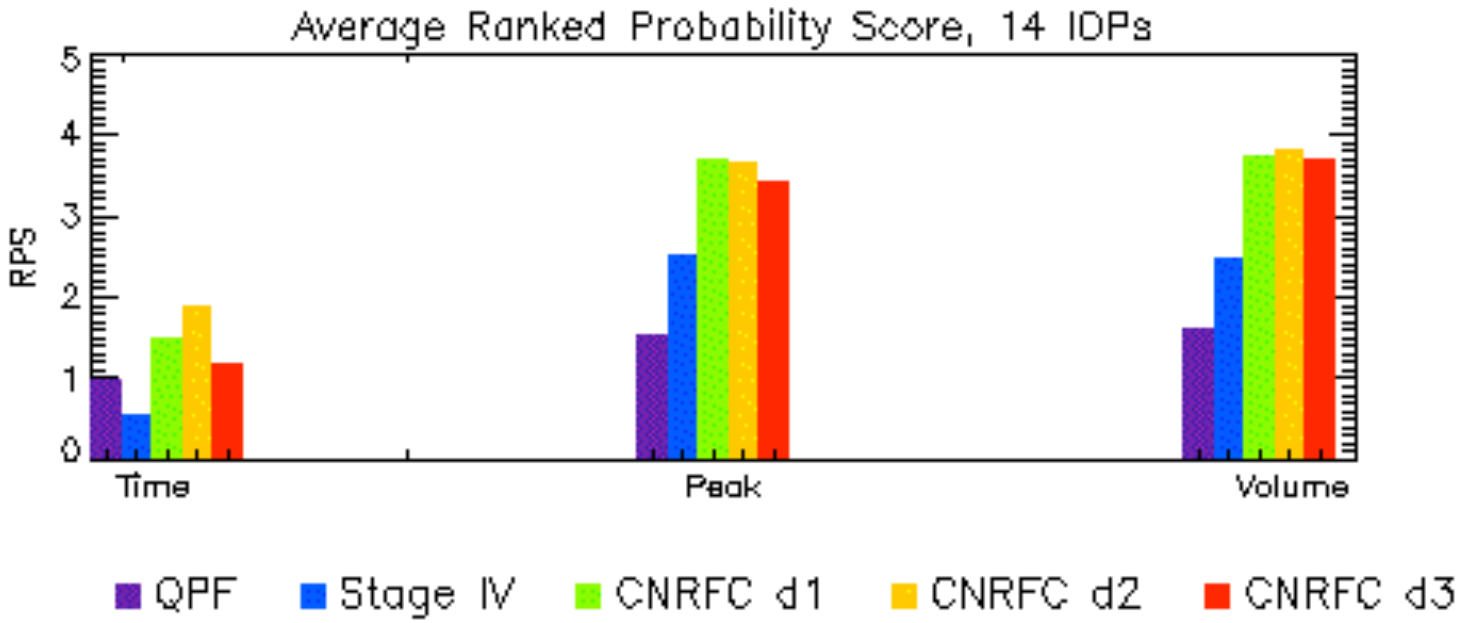
2) Stage IV QPE, ~ 4 km

3) CNRFC QPF day 1- day 3 forecasts, ~ 4 km



By Yuan, H.， J. J. Gourley, P. J. Schultz, J. A. McGinley, Z. Flamig, C.J. Anderson

Average skill scores for streamflow simulations from 14 IOPs



Ranked Probability Score (RPS) is computed for using the 0-6 h ensemble mean QPF, 6-h Stage IV, CNRFC day1 to day 3 forecasts with 14 IOPs during three winters (HMT-2006, 2007, 2008)

Smaller RPS is better. The high-reso ensemble QPF is the best in terms of peak and volume, and is worse than Stage IV input in the peak timing.

Publications

Jankov, I., P. J. Schultz, C. J. Anderson, and S. E. Koch, 2007: The Impact of Different Physical Parameterizations and Their Interactions on Cold Season QPF in the American River Basin. *Journal of Hydrometeorology*, Volume 8, pp. 1141–1151

Jankov, I., J-W Bao, P. J. Neiman, P. J. Schultz, H. Yuan and Al. B. White, 2009: Evaluation and Comparison of Microphysical Algorithms in WRF-ARW Model Simulations of Atmospheric River Events Affecting the California Coast. *Journal of Hydrometeorology* **10**, 847-870

Vukicevic, T., I. Jankov, and J. McGinely, 2008: Diagnosis and optimization of Ensemble Forecasts. *Monthly Weather Rev*iew 136, 1054-1074.

Yuan, H., J. A. McGinley, P. J. Schultz, C. J. Anderson, and C. Lu, 2008: Short-range precipitation forecasts from time-lagged multimodel ensembles during the HMT-West-2006 campaign. *Journal of Hydrometeorology*, 9, 477-491.

Yuan, H., C. Lu, J. A. McGinley, P. J. Schultz, B. Jamison, L. Wharton, and C. J. Anderson, 2009: Evaluation of short-range quantitative precipitation forecasts from a time-lagged multimodel ensemble. *Weather and Forecasting*, 24, 18-38.

FUTURE WORK

- Continue to improve winter season QPF and PQPF
- Microphysics related research
- Ensemble stream flow